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AVIATION NOISE RESEARCH NETWORK (X-NOISE)

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Resumo

X-NOISE é um projeto de rede de colaboração na área de aeroacoustics estabelecidos para reduzir a exposição da comunidade ao ruído das aeronaves. Nós nos esforçamos para coordenar actividades de investigação, divulgação dos resultados, e contribuir para uma base de conhecimento aeroacoustical. X-NOISE é tornada possível pela União Europeia. Ao longo dos últimos 10 anos, grandes e ambiciosos programas de investigação nacionais e regionais foram iniciadas paraapoiar inovações tecnológicas que visem uma maior redução do ruído de aeronaves. Tais iniciativas foram estabelecidos na União Europeia, os Estados Unidos, Japão, Canadá, Brasil e Federação Russa. O surgimento de estruturas de rede dedicado tem desempenhado um papel significativo na implementação e elaboração de sucesso dessas iniciativas várias. Tais estruturas foram então utilizados para desenvolver e consolidar estratégias de pesquisa pormenorizadas que atendam às metas de alto nível definidas pelas estruturas de investigação nacionais e regionais, estabelecendo as condições para uma pesquisa mais ativa e coordenada abrangendo todas as áreas relacionadas com a International Civil Aviation Organization (ICAO) Equilibrado abordagem. Dentro deste quadro, asredes oferecem, de fato a capacidade de efetivamente gerenciar clusters de projetos de pesquisa básica, bem como a transição para outras fases de demonstração de tecnologia. A concretização do objectivo fundamental de reduzir o ruído enfrenta desafios crescentos como o aumento do volume do tráfego aéreo, a menor tolerância para com o ruído na vizinhança dos aeroportos e a necessidade de atenuar os efeitos de uma maior variedade de fontes donoras, conduzindo a mais longo prazo a novas configurações de aviões. O caracter uma vez mais interdisciplinar da redução de ruído, as suas implicações na concepção de aviões e motores e as interacções com emissões e eficiência, exigem um esforço de coordenação mais amplo para abranger todos os aspectos relevantes desta problemática.

research programmes have been initiated to support technology breakthroughs aimed at further aircraft noise reduction. Such initiatives have been established in the European Union, the United States, Japan, Canada, Brazil and the Russian Federation. The emergence of dedicated network structures has played a significant role in the elaboration and successful implementation of these various initiatives. Such structures have then been used to develop and consolidate detailed research strategies addressing the high level goals set by national and regional research frameworks, establishing the conditions for a more active and coordinated research covering all areas related to the International Civil Aviation Organization (ICAO) Balanced Approach. Within this frame, networks provide in fact the capability to effectively manage clusters of basic research projects as well as the transition towards further stages of technology demonstration. The basic objective of noise reduction faces increasing challenges due to traffic growth, less tolerance to noise around airports, and the need to deal with a greater variety of noise sources, leading eventually to novel aircraft configurations. The increasingly interdisciplinary nature of noise reduction, its implications upon engine and aircraft design, and its interactions with emissions and efficiency, require a broader coordination effort to tackle all relevant aspects of the problem.

Key words: Aviation Noise

1.Introduction

To successfully address the objectives set for European research, a dedicated Aviation Noise Research Network (X-NOISE) has been established. It has developed its activities along a “3-Pillar” approach as described below:

-Definition, coordination and assessment of research strategies aimed at meeting the 2020 ACARE noise target (average reduction of 10 dB per operation relative to the 2000 situation).

-Dissemination and communication of the research effort scientific and technological achievements as well as issues and priorities for the future.

-Improved integration of European research community activities in the field of air transport related noise research

Schematically, the four contributors can be summarized as follows:

-Generation 1 Noise Technologies: improved / novel passive noise reduction techniques

-Noise Abatement Procedures : continuous descent approach, optimized takeoff procedures

-Novel Architectures: Advanced aircraft and engine concepts, optimized powerplant Installation

-Generation 2 Noise Technologies: multidisciplinary aeroacoustic design, active techniques,…

This phased approach has been elaborated through a process involving consultation of the scientific community as well as the major industrial stakeholders. It has now led to the effective implementation of a number of complementary projects. All through FP4 and FP5, an initial Phase 1 effort targeting the EC short/mid term improvement goal of 5dB was aimed at bringing a number of noise reduction technologies (Generation 1 solutions) to validation status (Technology Readiness Level 6). This effort was completed at the end of the SILENCE(R) project in 2007.
A significant and sustained Phase 2 effort has now been subsequently initiated to achieve the technology breakthroughs needed for full achievement of the ACARE goals. Such breakthroughs encompass a wider range of areas (examples: aircraft and engine « low noise » architectures, individual component aeroacoustic design associated with low weight technologies, innovative noise reduction techniques such as active / adaptive systems), each providing technology building blocks along the multidisciplinary path leading to an aircraft design optimized for minimal environmental impact.

Furthermore, as an indication of the wider range of expertise now mobilised through the network, a significant and coordinated effort has been launched to improve the understanding of psychoacoustic factors as well as provide aviation stakeholders and policy makers with better tools and knowledge to help manage the environmental impact of air transport operations.

3.Network Development

In parallel, improved integration of the research community at European level has been pursued. Through the various individual projects and the networking efforts carried out over the last ten years, the European aircraft noise research community has now reached a critical mass. As of 2011, more than 150 different organisations had participated in at least one project proposal over the last four EC framework programmes. Three priorities have driven the network efforts in the community building area:

To this end, a network of national Focal Points has been established to favor efficient coordination of expertise at national level. Representatives of CIS, South America and Mediterranean regions have also joined in the network to foster further international cooperation.

A new network development phase has now been launched through the X-NOISE EV Coordination Action.

4.Technological and Social Challenges

The predicted growth of air traffic at a rate of 3-5% per year, leads to a doubling of aircraft movements every 15-25 years. In some regions of the world new airports are being built (eg Asia), whereas in others (eg Europe) there is increasing local resistance even to adding new runways to existing airports. A decrease in overallnoise exposure as traffic grows implies that the noise signature per movement must be significantly reduced. Some airports already apply local noise standards that are stricter than the international ICAO regulations; these local standards (eg at Heathrow) are taken into account by Boeing and Airbus in the design of every new aircraft. The emergence of emission limits (CO2, NOx, etc…) will create a further challenge of compatibility or compromise with noise standards.

Significant progress has been made since the dawn of the jet age to reduce engine noise, to the extent that it is now dominated by airframe noise in certain flight phases, like approach with engines at idle. This is motivating the development of new technologies to reduce airframe noise. The study of psychoacoustics may lead to a reduction in the subjective annoyance of both engine and aerodynamic noise. The tailoring of take-off and approach flight paths to reduce the noise footprint on the ground will take into account engine management, aerodynamic configuration and psychoacoustic exposure.

Ultimately the noise reduction at component or sub-system level will not be sufficient, and will have to be incorporated into novel aircraft configurations with features such as: noise shielding by wing or fuselage or buried engines, faired undercarriage, variable camber flapless wing, etc… These technologies will require an increasing integration of noise reduction techniques into overall engine and aircraft design atthe earliest stages, to ensure compatibility with reduced emissions, low cost and high-efficiency. Thus noise reduction becomes an essential part of the multidisciplinary design, development, certification and operation of aircraft. The multi-faceted aspects of noise reduction require an increased coordination effort to cover in a balanced and synergistic way the variety of technologies involved and their implications in the overall aviation sector.

-formulates, through development of common strategies and complementarity with national activities, priorities and key topics for future projects aimed at noise reduction at source, low noise operations, and improved understanding and modelling of the impact of aircraftnoise in the community, including environmental interdependencies.
- ensures dissemination and exploitation of research findings, including technical information aimed at Regulatory Bodies and Policymaking Agencies.
-contributes to an improved integration of the European Aircraft Noise Research Community through a network of National Focal Points covering all countries with a technical interest in Aviation noise.
-identifies potential reinforcement of future projects partnership through extended international networking and dedicated processes to foster new collaborations and promote novel ideas.

More generally, as lasting organizations beyond the limited timeframe of individual projects, research networks ensure a much needed structural continuity aimed at longer term strategies. In linking together, they also play a key role in addressing wider issues such as the development of a concerted research approach for transport noise as whole, improved knowledge of noise-emissions interdependencies and the development of international cooperation opportunities.

6. List of research projects

TEAMPLAY: Tool Suite for Environmental and Economic Aviation Modelling for Policy Analysis

ORINOCO: cOoperation with Russia in the field of advanced engIne NOise COntrol based on plasma actuators

NINHA: Noise Impact of aircraft with Novel engine configurations in High Altitude operations

VALIANT: Validation and Improvement of Airframe Noise prediction Tools

COSMA: Community Oriented Solutions to Minimise aircraft noise Annoyance

OPENAIR: OPtimisation for low Environmental Noise impact

FLOCON:Adaptive and Passive Flow Control for Fan Broadband Noise Reduction

TEENI: Turboshaft Engine Exhaust Noise Identification

DREAM: Integrated approach to novel engine architectures

ERAT: Environmentally Responsible Air Transport

VITAL: VITAL is a European research & technology programme which aims to reduce aircraft

PROBAND: Improvement of Fan Broadband Noise Prediction: Experimental investigation and computational modelling

MESSIAEN: Methods for Efficient SimulationS of Aircraft Engine Noise

TURNEX: Turbomachinery noise radiation through the engine exhaust

SEFA: Sound Engineering For Aircraft

COJeN: Computation of Coaxial Jet Noise

IMAGINE: IMAGINE -developing new calculation methods for railway, road, industrial and aircraft noise.

JEAN: Jet exhaust aerodynamics and noise

ROSAS: Research on Silent Aircraft Concepts

TURBONOISE: Turbomachinery noise source CFD models for low noise aircraft engine designs

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References

[1] www.xnoise.eu